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Glycogen level in the different body part of cerebralectomized, bivalve mussel *Lamillediens Corrianus*

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ABSTRACT

Lamellidens corrianus (Shell length 95-110mm) from Nandrabad pond, Aurangabad in winter seasons were collected and were acclimatized in laboratory condition for 2 to 3 h and surgerical operation were made for removal of cerebral ganglion unilaterally and bilaterally after lapse of 24h. The animals were placed into 3 groups. The glycogen content was determined after 7 days during winter season from adductor muscle, mantle, hepatopancreas, gonad, siphon, foot, and gills. The glycogen content was significantly $p<0.001$ increased in gonad and significantly $p<0.001$ decreased in hepatopancreas in control group animal except in bilaterally cerebralectomized group. The result obtained is discussed in the light of metabolic shifts in bivalve mollouscs.

Key Words: Glycogen, *Lamellidens corrianus*, winter and cerebralectomized.

1. INTRODUCTION

Bivalves: Bivalves amongst the aquatic organisms of the commercial important mussel constituents a remarkable component in the littoral ecosystem and generate considerable research interest by virtue of their wide spread distribution and specific ecological adaptation and edible value. Freshwater mussels are distributed worldwide in lotic and lentic habitats. Freshwater bivalve molluscs (class Bivalvia) fall within the subclass Lamellibranchia and are characterized greatly. Freshwater mussels have two shells, or valves, arranged left and right. The earliest part of the shell is called the beak or umbo. The shell expands along the margins as the animal grows. Most freshwater mussels have a dorsal area called the hinge, which has interdigitating projections called teeth. These teeth serve to keep the shells aligned and prevent shearing during burrowing. The anterior-most teeth are called the cardinal (or

pseudocardinal) teeth, whereas the posterior teeth are the lateral (or pseudolateral) teeth. Some mussels lack teeth altogether. The shells are held together in life by two adductor muscles which close the shells. These muscles counteract the ligament, a non-living proteinaceous structure which acts as a spring to open the shells. The muscular foot protrudes from the anterior half of the shells; the siphons, the openings through which water enters and exits the shells, are located posterior. On the inner surface of the shells are scars, sites of attachment for various muscles, including the adductors and the pallial line—the linear scar where the mantle tissue is anchored to the shell. The molluscs are divided into six classes: Monoplacophora, Polyplacophora (= Amphineura, chitons), Gastropoda (snails), Pelecypoda (bivalvia, clams), Cephalopoda (squids and octopus), and Scaphopoda (tooth shells) (Jayabal & Kalyani 1986; Lodeiros et al. 2001; Gardner and Malczyk, 1991).

Glycogen: Most of the living organisms derive their energy by the metabolic breakdown of carbohydrate. The chief reserve in the tissue is glycogen, which is release glucose, an utilizable sugar by glycogenolysis according to the physiology demands of the organism. Any change in environment is known to have effects on the nervous system which in turn induce alteration in biochemical processes, especially those concerning carbohydrate metabolism, (Prosser, 1984). Seasonal changes in biochemical have been reported b y, many workers, Ansell et al (1964), De Zwann and Zandee (1972), Gabbott and Bayne (1973) determine seasonal changes in biochemical composition of adductor muscle, mantle, siphon, and foot in *Mercenarid mercenarid* and *Mytilus edulis.*

Ganglia: In bivalves the endogenous factors like the endocrine gland secretions and the exogenous factors like season, temperature, salinity, food availability etc, plays vital role in regulating the growth and metabolism. The nervous systems is primitive type and consist of three ganglia, cerebral, visceral and pedal ganglion which regulate growth, reproduction and all metabolic activity in bivalves (Joosse and Gerearts, 1983; Sokolove et al. 1984; Flari and Edwards, 2003).

2. SCOPE OF THE STUDY

The aim of carrying out this research is to determine the effect of cerebralectomy in bivalve in winter in accordance with the glycogen content in anterior adductor muscle, posterior adductor muscle, gonad, gills, mantle, siphon, hepatopancreas and foot. As these bivalves are of commercial important and can be utilized in freshwater aqua culturing to fulfill the nutritional demand of the growing population.

2.1. Materials

The materials used include the required soft tissues of the freshwater bivalves mussel which in this experiment. The, burette, pipette, weighting balance, conical flasks, filter paper, dissection box, and mortal pastel.

2.1.1. Reagents/Chemicals

Estimation of Glycogen

The total glycogen was estimated, by employing the method of De Zwaan and Zandee [1972] using the anthrone reagent

Reagents

Anthrone Reagent: Dissolved 150 mg of anthrone in 100 ml of conc. H_2SO_4.
30 % KOH
96 % ethyl alcohol.

2.2. Methodology

100 mg tissue was homogenized in 30 % KOH and the mixture was kept in boiling water bath for 3 to 5 minutes to dissolve the tissue and then cooled. To this 2 ml of 96 % ethyl alcohol was added and the mixture was kept overnight in refrigerator at 12 º C. Next day this mixture was centrifuged at 3000 rpm for 15 minutes to settle down glycogen cake. 2 ml of distilled water was added to the cake and mixed well. This mixture was kept in water bath for 10 minutes and optical density was read at 610 nm using UV-VIS Spectrophotometer against blank. Glucose was used as a standard. To calculate the glycogen by using 0.93 conversion factor to get glycogen mg / 100 mg tissue. Glycogen content in tissue was calculated with the help of standard graph and expressed as mg / 100 mg dry tissue.

2.3. Methodology

The freshwater bivalve mollusks, *Lamellidens corrianus* inhabits in the Nandrabad pond situated in Khultabad, taluka 19km away from Aurangabad. During winter season the collection of 15 individuals of the shell length 95-110 mm were selected and were acclimatized to laboratory condition for 7 days. Surgical operations were performed so as to

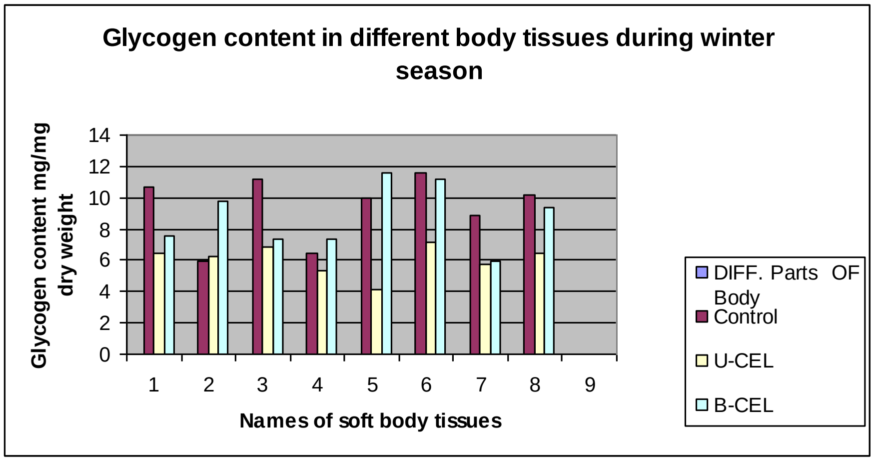

Figure 1

UCEL- unilateral cerebralectomy, BCEL- bilateral cerebralectomy

remove cerebral ganglia unilaterally and bilaterally within 30 seconds after lapse of 2 to 3 hours in the laboratory condition. The animals were divided into 3 groups non- operated served as control and other two were experimental. In each group 5 animals were selected and after lapse of 7 days the animals were sacrificed and the various body parts are dissected, mantle, anterior adductor muscle, posterior adductor muscle, gills, gonads, hepatopancreas, foot and siphon and dried in the oven to prepare the powder for estimation of glycogen content in various body parts by using standard method Anthrone method given by DeZwann and Zandee, (1972). The value of estimate was subjected to statistical analysis.

3. RESULTS

Statistical Analysis

The obtained data were statistically analysed by using, mean, standard deviation, standard error, coefficient of variance and student t-test as statistical technique (Mungikar, 2003) to draw conclusions (Figure 1).

4. DISCUSSION

Effect of cerebral ganglia, ablation in glycogen content of different body part in *Lamellidens corrianus*. During winter season compared to control, the glycogen content in cerebralectomized grouped animals showed decreasing trend. The total glycogen content in different body tissues Viz., mantle, anterior adductor muscle, posterior adductor muscle, gills, gonad and siphon except hepatopancreas & foot. The glycogen content in anterior adductor muscle was high in control 11.2359±0.1752, 6.8752 ±0.5198 and 7.342±0.3980 compared to cerebralectomized , in hepatopancreas the content is 5.9835±0.0556,6.2015± 0.0561and 9.7626± 0.0280 the content showed significant decreased by (54.28%) P<0.001 , in posterior adductor mussel it was 6.4193±0.0839, 5.3866±0.0316and 7.3906±0.0280. In gonad the content is 11.5913±0.4139, 7.1724± 0.00606 and11.2208+-0.0560, the control animals showed significant increased. In foot the content is 10.0255±0.0560, 4.1948 +0.0560and 11.6106±0.0280 in bilaterally cerebralectomized animals increased by-(48.07%). In gills the content was increased, in control group animals by (14.67%), in mantle the content is 10.7388±0.0280, 6.4827±0.0280and7.6048±0.0280, again a significant increase in the control group animals by (12.70 %), whereas in siphon an significant decreased was recorded in control by 9.25 % when compare to cerebralectomized animals respectively (Figure 1) Bivalves generally store carbohydrates in large amounts during their growing season and use them over the rest of the year (Beukema, 1997). Glycogen is the tuner carbohydrate stored in bivalves (Beukema, 1997). However, small amounts of free sugars are always present as well (Whyte and Englar, 1982). The glycogen content for FV, M, and GMS found in E. exalbida was comparatively lower than the other components (0.03% to 4.7% AFDW), in contrast with other studies in bivalves where high values occurred (31.9% to 48.4%), (Giese, 1966; Paez Osuna et al. 1993). Nevertheless, scarce glycogen stored in another burrowing bivalve, *Ensis siliqua*, has been observed (Martinez et al., 1997). Under conditions of food scarcity, it has been suggested that glycogen from muscular tissues acts as the primary energy reservoir for the formation of gametes in bivalves, such as Glycymeris glycymeris (Galap et al., 1997). A reduction of this reserve in storage organs is also commonly correlated with an increase in gonadal lipids (Fernandez-Reiriz et al. 1996; Mann, 1979). In the adductor muscle of E. exalbida, glycogen content increased during the spawning event (November, in males) and the gamete maturation (summer, males and females) and decreased in the rest of the year, suggesting that glycogen is used in these months but in a very low proportion (<3.3%). Thus, these changes had not been detected in a direct calorimetric analysis, Lomovasky et al. (2001). Therefore, the adductor muscle in E. exalbida does not have glycogen storage functions for energy reserves in contrast with previous reports for several bivalves such as scallops (Ansell 1974b; Robinson et al. 1981; Sunder and Vahl, 1981; Mussels and Lowe et al. 1982). *In Ostrea pulchana* the glycogen content reports related to biochemical composition, age, weight, size, and energy value, showed deplication in glycogen content shown by, Bayne and Thompson (1970) which supports the present study. Similarly, Muly (1988) observed that glycogen content decreased. Berthelin et al. (2000a) measured the biochemical composition of different tissues including the adductor muscles, gonad/mantle and digestive gland. They concluded that proteins from muscle tissue contributed little to the reproductive tissue which forms from glycogen and lipids stored in the digestive gland, mantle, and gonad. These changes are consistent with the biochemical composition of the

reproductive and somatic tissues investigated in the present study. This suggests that somatic tissue growth occurs over the winter and continues during gametogenesis. This contrasts with some bivalve species where somatic and shell growth is inhibited during gametogenesis and spawning Harvey et al., (1993); McLachlan et al., (1996), the maximum and minimum accumulation of glycogen content in the different body tissue, is too functional significant in the different seasons. In the present study, based on differences, the removal of cerebral ganglia unilaterally and bilaterally affects the glycogen content from all body tissues of *Lamellidens corrianus* when compared to control in winter season. Thus, it can be concluded that cerebral ganglia may plays an important role mostly inhibitory one, in regulation of metabolic rate, organic reserve from different body component. The effect was pronounced in unilaterally cerebralectomized group animals.

5. CONCLUSION

1. Thus, it can be concluded that cerebral ganglia may plays an important role mostly inhibitory one, in regulation of metabolic rate, organic reserve from different body component.
2. On general experiment showed that the effect was pronounced in unilaterally cerebralectomized group animals, these biochemical content can be utilized for freshwater aquaculture to develop at commercial purpose in provision of adequate nutrition for growing population.

SUMMARY OF RESEARCH

1. This work, within the limit of available resource, has provided useful information as to what part of the body soft tissue which content more amount of glycogen.
2. It has availed scientists the opportunity to research more on the usefulness of species in nutritional management and to fulfill the demand of growing population as an alternative for supplementary food.

FUTURE ISSUES

From the findings, the glycogen content would be the good sourced for supplement food, suggesting that a good means employed for freshwater aquaculture for commercial production to boast good health for growing population.

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Dongre et al.
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